# The State of Ohio's Urban Environment: Geographic Patterns and Recent Trends[1]

David H. Kaplan, Carrie Bender, Petronella Kigochie, and James Pleasants, Department of Geography, Kent State University, Kent, OH 44242

**Abstract: The urban environment in Ohio has changed dramatically over the last thirty years, with areas of improvement and areas of degradation. This paper seeks to inventory the state of Ohio's environment in terms of a set of key environmental indicators: conversion of open spaces, changes in farmland acreage, loss of wildlife habitat, number of endangered plant species, brownfields, air pollutants, and lake quality. We attempt to accomplish two broad objectives in this paper. First, we look at the geographic pattern of these environmental quality indicators, paying particular attention to the major metropolitan areas. Second, we examine how these aspects of environmental quality have changed over the past two or three decades, noting areas of progress and of deterioration. Overall we find that air quality in Ohio has clearly improved, although Ohio lags behind other states. The expansion of urbanization has resulted in environmental degradation especially in regard to declining wetland acreage, farmland, and wildlife habitat. Water quality and parkland acreage show no clear change in either direction. We find throughout a need for more comprehensive data on these environmental indicators, so that policy makers can understand what needs to be accomplished.**

**OHIO J SCI 101 (5):79–89, 2001**

## INTRODUCTION

The urban environment in Ohio has changed dramatically over the last thirty years. Environmental indicators in relation to air and water quality have improved in many respects. Recycling has become more accepted and has helped mitigate problems of waste disposal. People have become more conscious of the environmental consequences of particular actions and governments have responded with environmentally sensitive policies. At the same time, Ohio cities continue to sprawl, resulting in the conversion of open space, the loss of wildlife habitat and threats to endangered species, and the increased reliance on automobiles. The urban environment of inner cities has also been affected by this geographic spread, as abandoned factory sites proliferate throughout many urban areas.

The environment in Ohio's urban regions must be considered along with other changes that have occurred over the past several decades. Changes in demography, economic development, and land use have led to a process whereby more and more of Ohio's land has been brought into "urban" uses. This has been a consequence of a slow general growth in Ohio's population, a slight shift of population from rural to urban areas, and the continued decentralization of Ohio's cities as more people leave the urban core for suburban and exurban areas. This last factor has been the most important by far and has resulted in a continued, if uneven, cycle of rural areas near to cities being converted to urban uses, followed by the conversion of rural lands further out. In some metropolitan areas, like that of Cleveland/Akron, overall regional populations actually declined between 1970 and 1990, even though the urbanized area expanded considerably.

We attempt to accomplish two broad objectives in this paper. First, we look at the geographic pattern of indicators of environmental quality, with particular attention paid to the major metropolitan areas (Fig. 1).

Second, we examine how these aspects of environmental quality have changed over the past two or three decades, noting areas of progress and of deterioration. Increasingly, environmental problems are urban problems as well. More people live within cities and urban areas have come to comprise more and more land.

### What Factors We Examined And Why

The urban "environment" is composed of several factors: impacts on land, wildlife, surface water, air, and

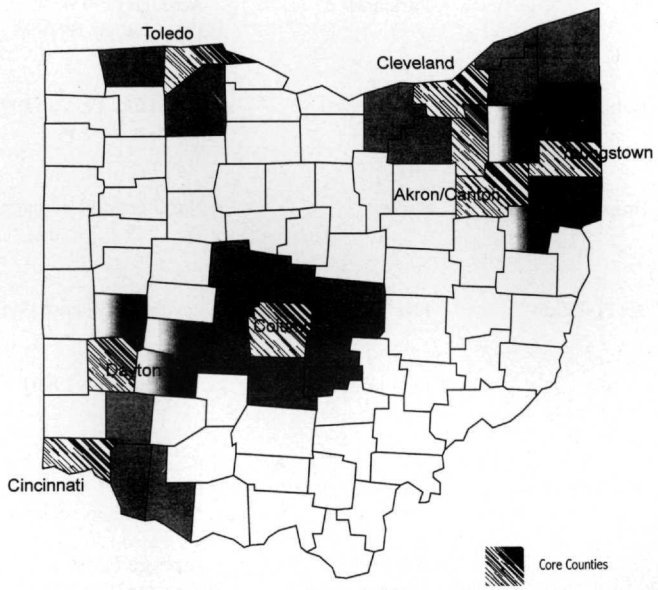


Figure 1. Location of Ohio's MSAs.

[1]Manuscript received 6 October 2000 and in revised form 2 July 2001 (#00-16).

other elements. Because the categorization of all of the relevant factors is so voluminous, we tried to acquire a representative sample of what we thought were the most significant variables available from state and federal agencies. Geographically, we were most interested in acquiring data at the county level to facilitate comparisons between and within metropolitan areas (Table 1). We felt that such data would provide a good combination of detail and generalization. Moreover, it was the scale at which much of the information is already collected. Temporally, we sought to gather the most recent information for each variable and then to compare it with data from past years. Our selection of data had much to do with what types of indicators we found relevant, but it was also conditioned by what data was available.

While we were able to uncover most of the data that we had sought to collect, the availability and quality of data varied greatly. The largest problem was that some variables were incomplete in their coverage. Only about 62% of Ohio's lake surface has been measured by the Lake Condition Index; and urban brownfield data are notoriously difficult to collect. Other data—such as recreational acreage, endangered plants, and urbanization—were far more complete but may have additional problems.

## LAND USE

Underlying each environmental change of the past decades has been modifications in the ways that land is used. Probably the most visible aspect of this change has been the spread of urban land into rural areas. This process has become widely known as "suburban sprawl" and has recently spurred a number of voter initiatives and suggested policy changes. The Clean Ohio Fund, passed in November 2000, was a statewide response to the threat of urban encroachment. It provided funds for farmland preservation, green space preservation, stream and watershed protection, recreational trails. Other actions at the county and subcounty level—notably the establishment of farmland preservation task forces—have also taken place. Other environmental consequences of suburban sprawl are significant and related: wetland destruction, habitat modification, farmland loss, growing areas of environmental contamination, even the parks that have been developed to provide a way for an overwhelmingly urban population to experience nature.

### Urbanization

The overall rates of urbanization are disputed by various organizations. Groups like the Sierra Club tend to maximize the amount of land converted from rural to urban uses each year, while groups like the National Association of Home Builders offer much lower figures. In this case, as in every case throughout our study, we seek to find official sources of information in the hopes that these are the most impartial.

TABLE 1

| Issue | Variable | Data | Units | Source | Comprehensiveness |
|---|---|---|---|---|---|
| Land Use | Urbanized land | Acreage (5 years)<br>Pct. Change 1982-92 | County | Natural Resource Inventory | complete |
| | Farmland | Acreage (1995)<br>Pct. Change (1974-92) | County | Ohio Agric Stats | complete |
| | Parkland | Acreage (1993)<br>Pct. Change 1986-93 | County | SCORP report | complete |
| Habitat | Endangered Plants | # Endang. Plants (1997)<br>Change 1986-97 | County | Ohio Division of Natural Resources | complete |
| Brownfields | Survey | Numbers and acreage | Cities | US Conference of Mayors | Many cities missing |
| Air Pollution | Five pollutants | Levels (1980 and 1990) | Counties | Environmental Protection Agency | complete |
| | Five pollutants | Trends (1986-1996) | State | Environmental Protection Agency | complete |
| Water Quality | Lakes | LCI index<br>Metropolitan regions | Individual Lakes | Ohio Water Resource Inventory | Many lakes missing |
| | Wetland Acreage | Acreage (1992)<br>Change 1982-92 | County | Natural Resource Inventory | complete |

In order to get county level data, we used data compiled by the National Resources Inventory of the U.S. Department of Agriculture (Natural Resources Conservation Service, 1999). These inventories are conducted every five years, and provide information on the status of land and related resources on non-Federal property. The inventory is based on the survey of various sample points throughout each county, and the determination of land use within this sample point. Among the land uses covered by this inventory are urban and built-up land (which includes residential, commercial (including highway strip development), industrial, land used for transportation (including parking lots), infrastructure, cemeteries, and golf courses). Areas that are considered part of the rural land base, like farmsteads, isolated houses, mines, and farm operations, are not included.

Table 2 shows the percentage of land within each of the seven metropolitan areas that are classified as urban as of 1992 (the latest date for which information is available). This indicates some variation between metropolitan areas, with the Cleveland MSA carrying the highest overall percentage and Columbus MSA the lowest. It also shows that each MSA includes primarily undeveloped land.

Between 1982 and 1992, each of these metropolitan areas registered an increase in urbanized land. Also, considerable variations exist between the "core" counties which contain the central city, and the outer counties. This variation is indicated in the accompanying map (Fig. 2).

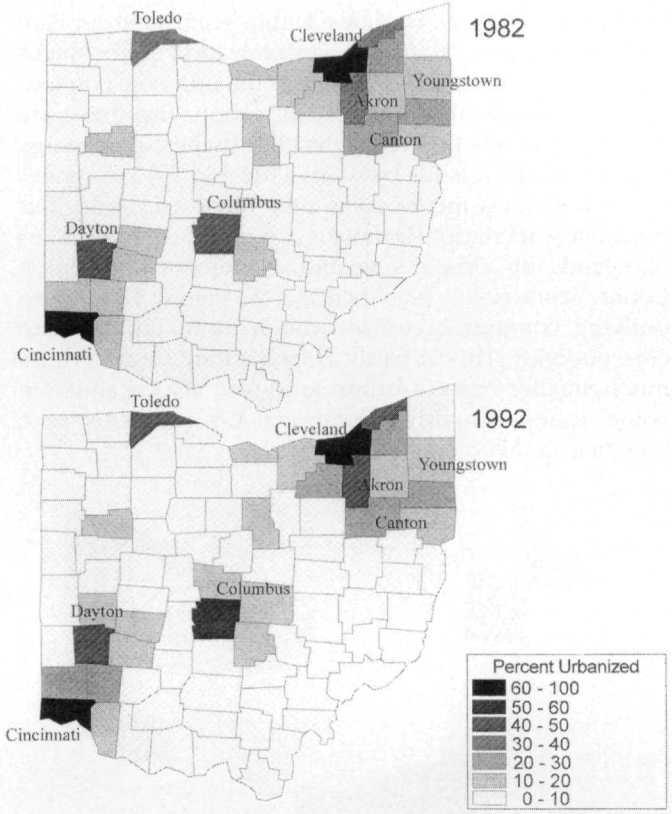


FIGURE 2. Percent of county in acres classified as urbanized: 1982, 1992, change from 1982-1992. Source: Natural Resources Conservation Service (1999).

TABLE 2

| MSA | Counties | Acres of Urban Land | Total County Acreage | County Land % Urban-1992 |
|---|---|---|---|---|
| Cleveland | Cuyahoga | 211300 | 295040 | 71.6 |
| | TOTAL | 492400 | 1747840 | 28.2 |
| Akron | Summit | 122500 | 268800 | 45.6 |
| | Stark | 95000 | 371200 | 25.6 |
| | TOTAL | 271600 | 1217280 | 22.3 |
| Columbus | Franklin | 197200 | 348160 | 56.6 |
| | TOTAL | 363000 | 2308480 | 15.7 |
| Cincinnati* | Hamilton | 183800 | 264320 | 69.5 |
| | TOTAL | 302000 | 1135360 | 26.6 |
| Dayton | Montgomery | 133700 | 296960 | 45.0 |
| | TOTAL | 246500 | 1082240 | 22.8 |
| Toledo | Lucas | 94500 | 223360 | 42.3 |
| | TOTAL | 146900 | 880640 | 16.7 |
| Youngstown | Mahoning | 63700 | 272000 | 23.4 |
| | TOTAL | 188500 | 1022080 | 18.4 |

* Cincinnati includes only those counties within Ohio.
Note: The named county is the core county, containing the metropolitan area's central city.
Source: Natural Resources Conservation Service (1999)

Clearly the outer counties within each metropolitan area are far less urbanized—urbanization percentages metropolitan areas, and nearly all of the non-core counties are less than twenty-five percent urban. But these are also the counties that registered the highest percentage increase in urban lands between 1982 and 1992. Counties in the Columbus metropolitan area recorded the highest percentage increases. Delaware County increased its urban lands by almost seventy-five percent and Union County witnessed a 42% increase. As Figure 3 indicates, outlying counties urbanized much more rapidly than core counties. This is partly because they began with a much smaller base of urban land and also because in some cases—notably Cuyahoga County—the core counties are almost fully urbanized.

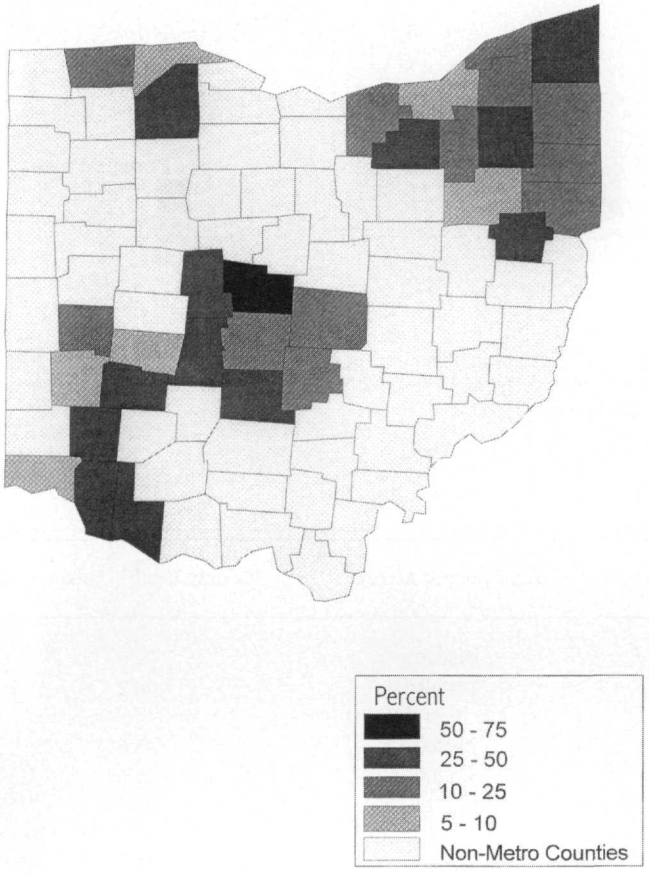


FIGURE 3. Percent change in amount of urban acreage, 1982-1992. Source: Natural Resources Conservation Service (1999).

## Changes in Farmland

Agriculture is Ohio's leading industry, contributing about $68 billion to the economy as of 1997 (Ohio Department of Agriculture, 2001). Ohio is also one of only four states that has more than fifty percent of land classified as "prime," where soil and drainage conditions are optimal (Ohio Department of Agriculture, 1995). While correctly viewed as a rural business, there remain a large number of farms within Ohio's metropolitan areas. Even the most urbanized of Ohio's Counties—Cuyahoga—recorded 140 farms in 6000 acres in 1995. Other urban core counties reported even greater numbers of farms and farmland The following map summarizes the percentage of farmland in each county (Ohio Department of Agriculture 1995). The top map in Figure 4 shows a clear pattern of difference between the heavily agricultural western part of the state, and the lower agricultural usage of much of the east.

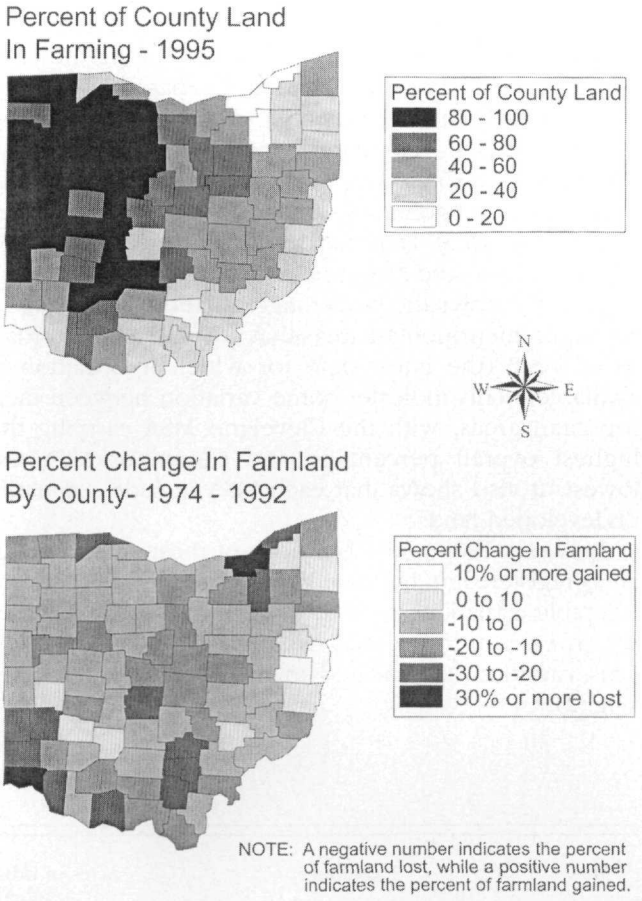


FIGURE 4. Percent of county land that is farmland. Percent change in farmland by county. Source: Ohio Department of Agriculture (1995).

Throughout the state, there has been a decline in the amount of land in farms over the past several decades. The changes have resulted mainly in a decline in the number of farmers and the conversion of land to other uses. Greater urbanization within metropolitan areas can certainly be listed as one of the factors that has resulted in changes in the amount of available farmland, although it is by no means the only factor. The bottom map in Figure 4 documents the percentage change in farmland between 1974 and 1992. In all except for two counties, the amount of farmland declined in those eighteen years. The heaviest declines were recorded in the core metropolitan counties of Cuyahoga (Cleveland), Hamilton (Cincinnati), and Franklin (Columbus) as land was converted to urban use. The peripheral counties in many metropolitan areas were also affected, and it might be expected that continued suburbanization would result in further declines as well.

The loss of farmland and open space has led to some major political initiatives. In August 1996, Governor Voinovich created the Ohio Farmland Preservation Task

Force. As a result of the recommendations of that task force, an Office of Farmland Preservation was established in the Department of Agriculture. Individual counties have also established task forces in which various strategies, including purchase of development rights, transfer of development rights, zoning changes, agricultural easements, and other methods for helping farmers continue to maintain and expand their holdings.

**Parks and Habitat**

One way for rapidly urbanizing metropolitan areas to minimize some of the more negative impacts of urbanization while continuing to provide residents with green space is the provision of protected areas: parks, preserves, and other outdoor facilities. These protected areas provide city and suburban dwellers with recreational opportunities, places to bicycle or walk, environmental education, and just simply opportunities to be outdoors. They also provide important greenery that can help moderate the climate, cut down on pollution, and provide plants and wildlife with suitable habitats (Ohio Department of Natural Resources, 1993).

According to the Statewide Comprehensive Outdoor Recreation Plan (SCORP) (Ohio Department of Natural Resources, 1993), outdoor recreation in Ohio is divided between federal lands (16.5%), state lands (35.3%), local parks (6.4%), and other authorities responsible for the provision and maintenance of land. Taken together, this constitutes just over 1.4 million acres, or about five percent of total land in Ohio. Figures on parkland acreage do not assay quality, availability, or accessibility of these acres.

The three maps in Figure 5 provide different views of the distribution of protected acreage in Ohio. The middle map shows the percentage of total county land devoted to protected outdoor acreage. It is clear that—with the exception of some rural southeastern counties with their wealth of forestland—metropolitan counties, and particularly core metropolitan counties, protect a large percentage of their overall land. Cuyahoga County, Summit County (which contains Akron), and Lucas County (which contains Toledo) devote more than thirteen percent of their land to recreational outdoor uses. The other core counties devote less than ten percent, but still more than the average for Ohio. In general, outlying metropolitan counties devote less acreage, but there is a great deal of variation between them. Heavily agricultural counties also have little land available to be set aside. Looking at the amount of recreational acreage per person, on the top map, Ohio as a whole affords about 131 acres per 1000 people, and none of the metropolitan counties offer as much as half an acre per person. According to the SCORP report, Ohio, ranks among the bottom states in per capita availability of outside recreation lands.

The SCORP report also compares acreage in 1993 with acreage in 1986, allowing some analysis of short term trends (bottom map in Fig. 5). Longer term data were unavailable. As it is, the trends are inconclusive. There is a negligible change in the amount of protected, publicly accessible acreage statewide, but parts

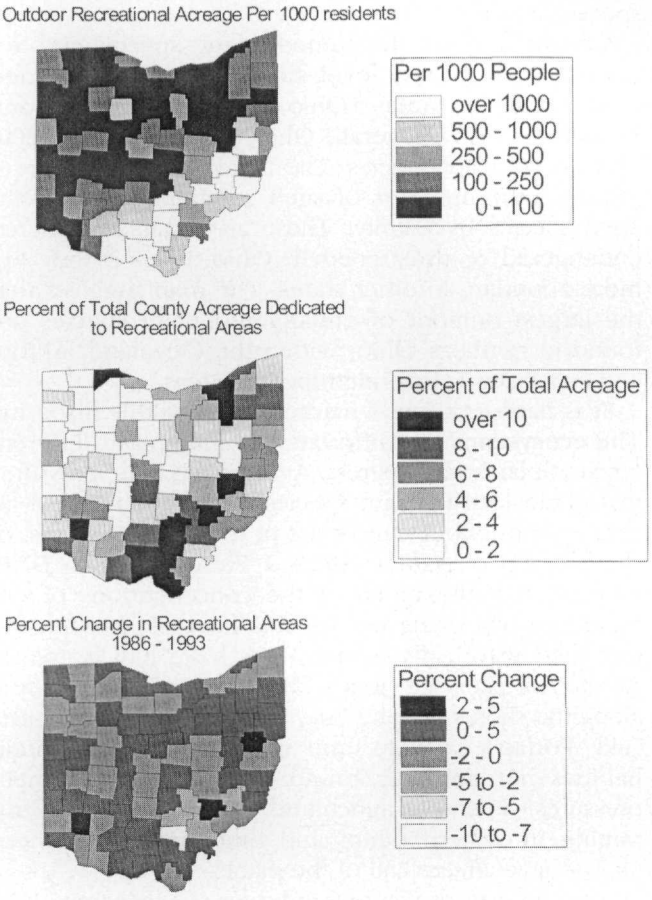


FIGURE 5. Outdoor recreational areas: acres per 1000 people; percent of total land dedicated to recreational uses; percent change in recreational land, 1986-1993. Source: Ohio Department of Natural Resources (1993).

of Southeast Ohio in particular appear to have suffered some severe reductions. William Daehler, of the Office of Real Estate and Land Management, Ohio Department of Natural Resources suggests that many of the differences can be attributed to methodological variations in how the data were collected (Daehler, 1999). In 1986, the collection was conducted largely through field work, whereas in 1993, a mail survey was used. Explanations for some of the larger reductions of several thousand acres could also be attributed to a private landholder no longer opening up his or her land to the public.

**Endangered Plant Species**

Land use might also be considered in terms of its implications for Ohio's flora and fauna, key indicators of environmental health. The Ohio Department of Natural Resources (1991) maintains a list of endangered or threatened animal and plant species. An "endangered" species is one threatened with extirpation from the state. The danger may result from one or more causes, such as habitat loss, pollution, predation, interspecies competition, or disease. A "threatened" species is one whose survival in Ohio is not in immediate jeopardy, but to which a threat exists. Continued or increased stress will result in its becoming endangered. Because they are not tied to a particular metropolitan geography, endangered animal

species are difficult to track.

Endangered or threatened plant species are recorded at the county level, however, and can be tied to metropolitan areas (Ohio Department of Natural Resources, 1999). Overall, Ohio contains about 1800-2000 native plant species. The bottom map of Figure 6 indicates the numbers of such endangered or threatened species by county. These are plants considered endangered or threatened in Ohio, even if they are more abundant in other states. The map suggests that the largest number of endangered plant species are found in northern Ohio, within the Cleveland, Akron, and especially Toledo metropolitan areas.

It is hard to know what accounts for this disparity. The ecosystems are different and may place different types of plants under stress. At the same time, pressures that could lead to plant species degradation would be similar throughout Ohio's urban regions. Pat Jones, of the Division of Natural Areas & Preserves, Ohio DNR, explains that the much of the concentrations of endangered or threatened species have to do with the fact that historically, some areas have had a greater diversity of plant life (Jones 1999). This is especially true along the shores of Lake Erie, in some glaciated habitats (like Portage County), and in counties that contain habitats not normally found in Ohio. Development pressures—intensive agriculture in western Ohio, strip mining in eastern Ohio, and timbering in southern Ohio—have affected all of the plants.

The top map of Figure 6 indicates changes from 1986 to 1997. Cleveland, Akron, and Toledo metropolitan areas show increases in the numbers of endangered and threatened species, in some counties this change was dramatic. By contrast, counties in the metropolitan areas of Columbus, Dayton, Cincinnati, and Youngstown do not manifest large numbers of endangered or threatened plants, nor is there evidence of a substantial increase in the numbers of endangered plants. Ms. Jones suggests that measures of change should be viewed cautiously, since much of the differences can have more to do with how the data were collected than chronicling a real change (Jones 1999).

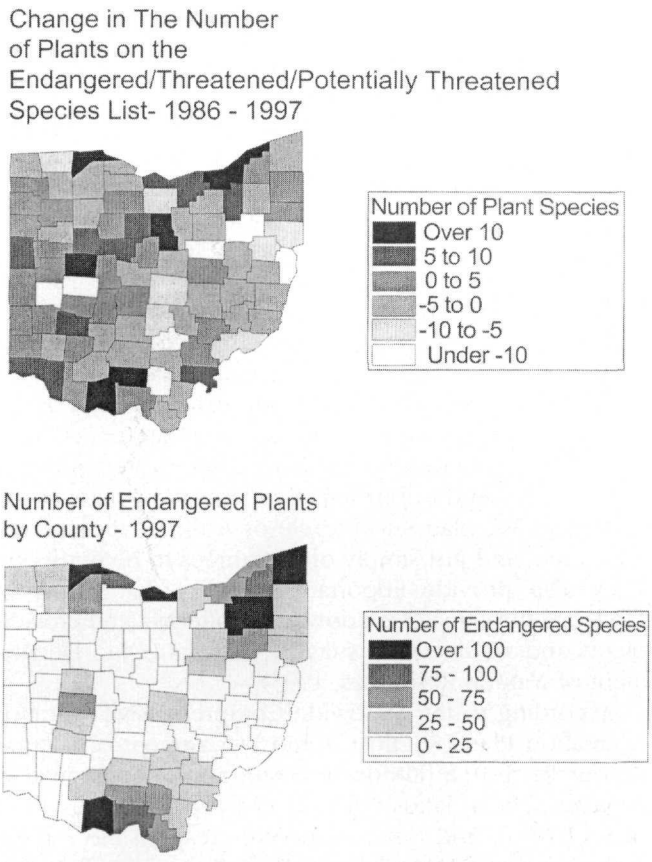


FIGURE 6. Number of endangered plants by county; change in number of endangered or threatened plants, 1986-1997. Ohio Department of Natural Resources (1999).

## Brownfields Sites

Among the pressing environmental concerns are those related to the presence of vacant industrial land within the cities. Much of Ohio's urban land was previously the site for factories. When the factories departed, the land was left in a somewhat contaminated state or was otherwise deemed unsuitable for new industry or other uses. This can be partially due to changes in industrial practices, a need for more land, and for fear of liability resulting from continued contamination. The federal Comprehensive Environmental Recovery Compensation Act imposes the costs of cleaning up property on current owners, even if they were not responsible. Attempts to convert the land to non-industrial uses can be equally difficult. The result is that the factories and other business enterprise consume "greenfields" on the rural periphery, while ignoring the already serviced "brownfields" in the center. Efforts to clean up and reuse these brownfield sites can be beneficial for the city while preserving more of the countryside.

No national or statewide data is collected for brownfields. This is partly because brownfields are so difficult to define, and every jurisdiction has its own definition. The U.S. Conference of Mayors (1999) defines a brownfield as an abandoned or underutilized property for which redevelopment is complicated by contamination. In Ohio, programs to identify and clean up brownfields rely on a self-selection process of those owners or officials who are interested in cleaning up a particular parcel of land.

The one source of general information comes from a survey sent out by the U.S. Conference of Mayors in April 1999 (US Conference of Mayors 1999). This survey asked cities to identify how many brownfield sites and how much brownfield acreage were contained within their boundaries. Table 3 shows the results for the cities in Ohio, and it must be remember that this is all self-reported data, and so probably uses inconsistent definitions. No data are available for Cincinnati and Youngstown, both cities where one might expect a great deal of brownfield acreage. Among the cities with information, Cleveland (and its suburb of Garfield Heights) clearly contains the largest number of sites, followed by Akron. Columbus contains a surprisingly limited amount of acreage designated as "brownfield," as does Toledo.

TABLE 3

| | Population | Sites | Acres |
|---|---|---|---|
| Akron | 221000 | 100 | 1000 |
| Canton | 84161 | 8 | 300 |
| Cleveland | 492901 | 350 | 6000 |
| Columbus | 635913 | 20 | 120 |
| Dayton | 178540 | 20 | 250 |
| Toledo | 322550 | 30 | 50 |
| Garfield Heights | 31739 | 20 | 450 |
| Kettering | 61000 | 1 | 2 |
| Lima | 45549 | 210 | 200 |
| Mansfield | 53000 | 4 | 30 |
| Springfield | 70487 | * | 300 |
| University Heights | 14900 | 20 | 10 |

Missing: Cincinnati, Youngstown

Source: US Conference of Mayors (1999)

In this same survey, most cities identified the lack of cleanup funds as the single most important impediment towards redevelopment. This was followed by liability issues and the need for environmental assessments. In addition, there is often a problem related to the fact that brownfields may be in areas where there are weak market demands or negative neighborhood conditions.

In Ohio, the main statewide program to revitalize brownfields is called the Voluntary Action Program (VAP) as conducted through the Ohio Environmental Protection Agency (2000). This allows landholders to clean up property on their own, and in return the state will issue a covenant not to sue. In addition, the state provides tax credits, loans, and grants to help facilitate cleanup operations. The passage of State Issue 1 (the Clean Ohio Fund) in November 2000 may also provide some assistance, by setting aside about $175 million in the next four years for the redevelopment of brownfields (Ohio Department of Development 2001).

## AIR POLLUTION

Air pollution may be the factor that most readily comes to mind in discussions of the urban environment. Along with surface water quality, it was one of the two major forms of pollution that sparked the early environmental initiatives of three decades ago. The Clean Air Act, enacted by Congress in 1970, inaugurated a series of regulations to diminish the concentrations of five specific air pollutants: ozone (volatile organic compounds), suspended particulates, sulfur dioxide, carbon monoxide, and nitrogen oxides. Since then, concrete actions have been taken to mitigate the pollution caused by point sources—such as furnaces, coal-fired boilers, gasoline terminals, chemical reactors, and storage tanks—and nonpoint sources, mainly automobile emissions. Control of these sources came much later, and data is available only for emissions from point sources. The collected data covers stationary sources whose actual or allowable emissions exceed particular thresholds for each of the particulates.

Since 1972, Ohio's air quality has steadily improved, providing the greatest success story of the environmental movement. Between 1980 and 1990, the declines were quite dramatic for both ozone and particulates, and fairly stationary for sulfur dioxide, nitrous oxide, and carbon monoxide. At the same time, Ohio's gross state product grew about nineteen percent and electric power generation also grew about thirteen percent. The following graph (Fig. 7) shows the general trends for each of the five air pollutants from across the state for the years between 1986 and 1996. Continued declines in particulate matter are evident, as are recent drops in sulfur dioxide. Ozone levels have also continued to decline into the 1990s. Taken together, this means that Ohio's air is significantly healthier. Using a national Pollution Standards Index (PSI), which characterizes air in regard to its overall healthfulness, Ohio's urban regions reached the unhealthful range only three days in 1996 as compared to 28 days in 1987. At the same time, the bottom graph shows that Ohio's air pollution was worse in 1996 than that of neighboring states.

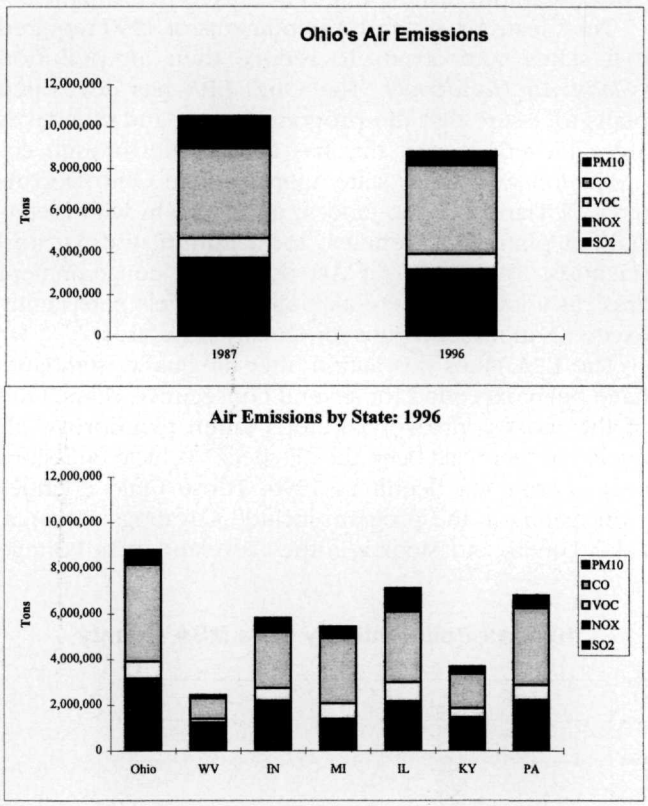


FIGURE 7. Air Indices: declining air emissions in Ohio; Midwest states compared. Source: US Environmental Protection Agency (2000).

Figures 8 and 9 graph pollution levels for the "core" MSA counties. During 1980 and 1990, both metropolitan and nonmetropolitan counties recorded "high" emission (defined as among the five counties each year with the highest emissions of one or more pollutants). Two metropolitan areas—Columbus (Franklin County)

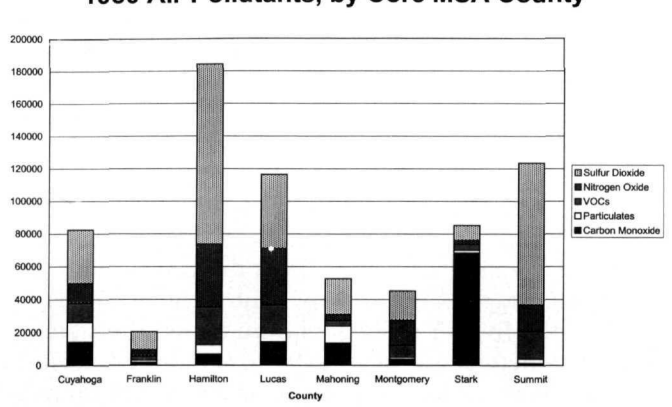


FIGURE 8. Air pollutants 1980, by county. Ohio Environmental Protection Agency (1995a).

and Youngstown (Mahoning County)—never reached high levels of emissions in both 1980 and 1990. Only Lucas County (Toledo) and Hamilton County (Cincinnati) recorded high emissions on more than one pollutant in both years. Cuyahoga County (Cleveland), Montgomery County (Dayton), Stark and Summit counties (Akron-Canton) turned in a more mixed performance.

The Clean Air Act and Amendments of 1990 required that states take efforts to reduce their air pollution (*Clean Air Handbook*). The Ohio EPA has developed plans to assure that the program's goals and objectives are achieved. In part this has been done through coordination with other state agencies, like Ohio Department of Transportation, and in coordination with metropolitan planning agencies, local administrators, and scientists. The Clean Air Act defines a "nonattainment area" as a locality where air pollution levels persistently exceed National Ambient Air Quality Standards.

The EPA takes this action after air quality standards have been exceeded for several consecutive years. One of the most controversial steps taken to improve air quality in Ohio has been the "E-check" vehicle emissions testing program, begun in 1996. Those Ohio counties participating in the program include Cuyahoga, Geauga, Lake, Lorain, and Medina in the Cleveland area; Portage and Summit in the Akron area; Clark, Greene and Montgomery in the Dayton area; and Butler, Clermont, Hamilton and Warren in the Cincinnati area.

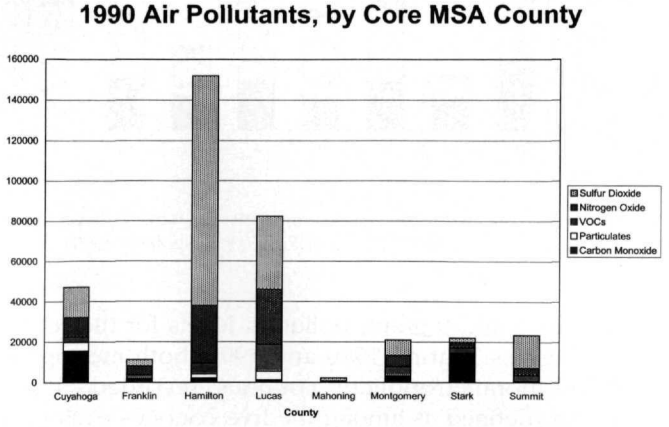


FIGURE 9. Air pollutants 1990, by county. Ohio Environmental Protection Agency (1995a).

## WATER QUALITY

Water quality is also an issue of great concern to Americans, and was one the factors which galvanized the environmental movement and led to the passage of legislation in the early 1970s (Clean Water Act). Ohio contains more than 25,000 miles of streams and rivers, a 451 mile border on the Ohio River, more than 5,000 lakes, ponds, and reservoirs greater than one acre, and 236 miles of Lake Erie shoreline. In Ohio, environmental action was precipitated by the long term degradation of Lake Erie and the obvious filth in rivers like the Cuyahoga.

### Surface Water

Water quality has been extensively monitored by the State since the 1970s. Surveys are conducted to assess a waterbody's health and whether these cleanliness levels are sufficient to meet standards for aquatic life and recreation. Water quality can be affected by a variety of stressors. Polluted runoff from rainstorms and snowmelt is the leading cause of impairment. Nutrients from farm fields and lawns, pesticides, industrial discharges, excess sedimentation, salt from road deicing, and habitat modification from development: these are all factors that can degrade the quality of surface and ground water. Nationally, it is estimated that 40% of surveyed rivers, lakes and estuaries are not clean enough to meet basic uses such as fishing and swimming. In Ohio, 50% of the waters meet the "swimmable/fishable" goal.

The sheer volume and detail of data related to Ohio's surface waters renders it difficult to provide a geographical snapshot of the health of Ohio's water bodies. The data on rivers and streams that we were able to acquire indicated steady progress. The Ohio EPA reported that 58% of all rivers and streams attained aquatic life uses in 1998, up from only 34% in 1988 (Ohio EPA web site).

As far as lakes are concerned, we were able to assess the condition of lakes by Ohio counties. Many (though not all) of Ohio's lakes have been recently surveyed on a variety of measures. For the sake of brevity, we use the measure of LCI (or Lake Condition Index). According to the *Ohio Water Resource Inventory, Volume 3* (Ohio Environmental Protection Agency 1996b), this index is a weighted sum of all lake condition parameters and so "provides a method for ranking the relative condition or ecosystem health of different lakes." Unfortunately, that measure was not available for all lakes. The Ohio EPA surveys 446 lakes with more than 5 acres of surface area, yielding a total of 118,717 surface lake acres in Ohio. 225 lakes containing 58,558 acres are in the seven metropolitan areas, and 36,429 or 62.2% of these metropolitan acres display current LCI data. Unfortunately, there were large differences between metropolitan areas in the degree of coverage. The Cincinnati MSA reports very little data on LCI levels, and so should not be considered in comparison. The other areas report more, but there is no way to determine whether

the missing data are in line with the available data.

Table 4 provides the best available snapshot of lake quality organized by the seven metropolitan areas. Lake acreage with data is divided into acreage with LCI under 21.5 (good quality), LCI between 21.5 and 30.8 (mixed quality), and LCI over 30.8 (poor quality). While comparisons are difficult, given the incomplete nature of the data, some items do stand out. The Youngstown area, for instance, is the only metropolitan area where a majority of lake acreage is considered high quality. Of those monitored lakes, 77.4% are considered "good" quality. By contrast, the Toledo area exhibits much lower levels, with 47.5% of monitored lakes registering a "poor" quality, and another 42.5% registering "mixed" quality. Most of the lake acreage in Akron-Canton, Cleveland, Columbus, and Dayton MSAs is considered "mixed."

The Division of Surface Water at Ohio EPA has set a goal that 75% of Ohio waters should meet the "swimmable/fishable" level by the year 2000 (Ohio Environmental Protection Agency 1995b). Some of the policies and tools employed to attain this goal are permits for the construction of wastewater facilities and discharge, state assistance to localities in mitigating the effects of discharge, biological and chemical monitoring of lakes and streams, and inspections of regulated facilities.

**Wetland Acreage**

According to the *Ohio: State of the Environment Report*, "the loss of wetlands represents one of the most significant changes in Ohio since the turn of the century." (Ohio Environmental Protection Agency 1995b) Only about ten percent of Ohio's original wetlands still exist—the second greatest decline in the United States after California—and today most of the threats to remaining wetlands comes from the byproducts of urbanization. The effects of such destruction are the loss of habitat, wildlife diversity, and flood control. Nearly one-third of the wildlife species in Ohio depend on wetlands for their survival, and more than half of all threatened and endangered terrestrial wildlife species are wetland-dependent.

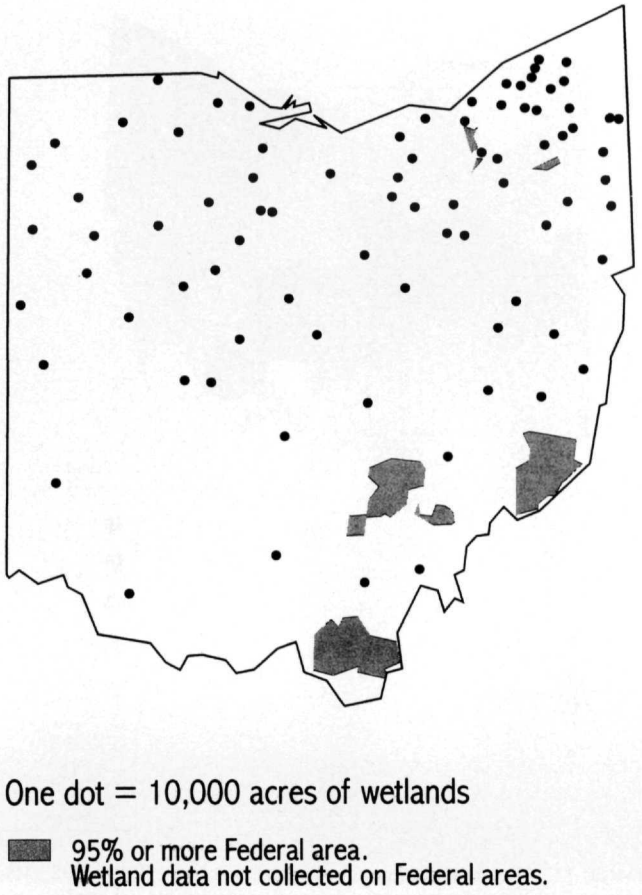


FIGURE 10. Percent change in wetland acreage, 1982-1992. Map Source: http://www.nhq.nrcs.usda.gov/land/meta/m5813.html

The accompanying map (Fig. 10) shows the total wetland acres in non-federal lands as of 1992. From this, it is clear that the majority of remaining wetland acreage is concentrated in northern Ohio, with a cluster near Lake Erie. Figure 11 shows the changes in wetland acreage for non-Federal areas and the percentage change in wetland acreage between 1982 and 1992. It suggests that decreases continued to occur, especially in northeast and central Ohio.

In 1994, the Ohio DNR and Ohio EPA convened a

TABLE 4

| MSA | Acreage of Public Lakes | % Acreage w/Data | % "Good"* | % "Mixed"* | % "Poor"* |
|---|---|---|---|---|---|
| Akron – Canton | 13191 | 57.4 | 1.89 | 68.55 | 29.56 |
| Cincinnati | 6095 | 2.8 | 0.00 | 0.00 | 100.00 |
| Cleveland | 7005 | 38.7 | 19.20 | 77.73 | 3.06 |
| Columbus | 14553 | 85.7 | 28.79 | 59.56 | 11.65 |
| Dayton | 2613 | 92.6 | 4.13 | 95.87 | 0.00 |
| Toledo | 504 | 40.1 | 9.90 | 42.57 | 47.52 |
| Youngstown | 14597 | 74.5 | 77.40 | 20.70 | 1.89 |

*"Good" = Lake Condition Index <21.5; "Mixed" = Lake Condition Index from 21.5-30.8; "Poor" = Lake Condition Index >30.8
Source: Ohio Environmental Protection Agency (1996b).

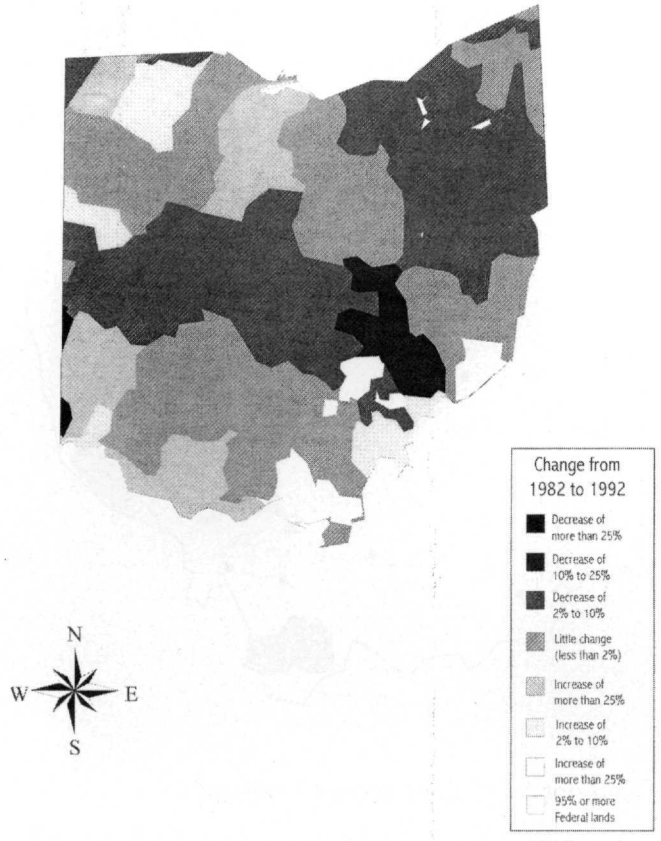


FIGURE 11. Percent change in wetland acreage, 1982-1992. Map Source: http://www.nhq.nrcs.usda.gov/land/meta/m3702.html

task force to develop a mission statement and to coordinate their efforts in stemming the loss of wetlands. Their mission, according to the Ohio Wetlands Program website (Ohio Environmental Protection Agency 2000b), was "to effectively manage, restore, protect, and expand wetlands by: developing an understanding of wetland resources; developing public support and understanding; and utilizing new and existing educational, regulatory, and incentive programs." The task force developed a series of "indicators of success", including more coordination between the two agencies, greater information on wetlands issues, speedier processing of Water Quality Certifications (which is a necessary permit for anyone who wishes to discharge dredged or fill material into the waters), the inventorying of high quality wetlands, a policy of "net gain" in the total amount of wetlands through restoration and creation, and greater public outreach. Action plans at both agencies have been designed to meet these general goals.

## CONCLUSION

While it is difficult to draw many general conclusions from such a diversity of data, it is evident that air quality, while still a problem in some regions, represents the greatest success for Ohio's environment. Likewise surface water quality has registered steady improvements, especially in regard to the cleanliness of lakes and rivers. Chief among the many areas of concern is the expansion of urbanization and the resulting changes to the landscape that have occurred. Wetland acreage continues to show declines, farmland has diminished, and habitats have been compromised. Despite some notable successes, the numbers of endangered plants has not changed as much. Parkland changes have also been hard to gauge, as any apparent changes may result from differing methodologies. And while there is some partial data on the current state of lakes, no comprehensive data exists by which to determine whether the quality of lake has improved or deteriorated. For the most part, data that are available are sound, and much of this has to do with good work of state agencies. There still remain several gaps in the coverage, as certain counties and cities are not included. In addition, we found it difficult to identify trends in several cases because of a lack of either earlier data, or where this existed, a consistent methodology.

In order to make effective decisions, officials need facts. The support and passage of the Clean Ohio Fund indicated that there is a bipartisan desire to work to improve the environment of urban, suburban, and exurban areas. What is needed, in many instances, is information that can be utilized in an effective manner, so that attention and funding can be put to where they are most needed.

ACKNOWLEDGMENTS. This study was instigated and supported by the Ohio Urban University Program as part of the State of Ohio Regions Project. The authors wish to extend their thanks to Jack Dustin, Tom Bier and Jane Dockery for their kind assistance. The collection of data required the help of a number of people in state and federal government. In particular, we would also like to thank Bob Parkinson of the USDA, Carolyn Caldwell, William Daehler, Pat Jones, and Wayne Jones of the Ohio DNR, and Karl Gebhardt of the Ohio Department of Agriculture.

## LITERATURE CITED

Natural Resources Conservation Service. 1999. Natural Resource Inventory. Washington (DC): US Dept of Agriculture. http:www.nhq.nrcs.usda.gov/NRI/

Ohio Department of Agriculture. 1995. Ohio Agricultural Statistics Annual Report. Columbus: Ohio Department of Agriculture.

Ohio Department of Agriculture. 2001. Quick Facts from Ohio's Agricultural Industry. http://www.state.oh.us/agr/quickag.html

Ohio Department of Development. 2001. Clean Ohio Fund – Implementation White Paper. http://www.odod.state.oh.us/cleanohio/pdf/011201cof.pdf

Ohio Department of Natural Resources. 1987-1997. Ground-water Pollution Potential Reports 1-46 . Columbus: Ground-Water Resources Section.

Ohio Department of Natural Resources. 1991. Ohio's Endangered Wild Animals. Columbus: Division of Wildlife.

Ohio Department of Natural Resources. 1993. Ohio Statewide Comprehensive Outdoor Recreation Plan. Columbus: Ohio Dept of Natural Resources.

Ohio Department of Natural Resources. 1999. County Distribution of Ohio's Rare Plants. http://www.dnr.state.oh.us/odnr/dnap/heritage/corange.html

Ohio Environmental Protection Agency. 1995a. Emission trends report for stationary air contaminant sources within the State of Ohio. Columbus: State of Ohio Environmental Protection Agency.

Ohio Environmental Protection Agency. 1995b. Ohio: State of environment report. Columbus: Ohio Comparative Risk Project.

Ohio Environmental Protection Agency. 1996a. Ohio Water Resource Inventory, Volume 1: Summary, Status, and Trends. Columbus: Division of Surface Water.

Ohio Environmental Protection Agency. 1996b. Ohio Water Resource Inventory, Volume 3: Ohio's Public Lakes, Ponds, Reservoirs. Columbus: Division of Surface Water.

Ohio Environmental Protection Agency. 2000a. The Ohio Voluntary Action Program. http://www.epa.state.oh.us/derr/volunt.html

Ohio Environmental Protection Agency. 2000b. Ohio Wetlands Program. http://chagrin.epa.state.oh.us/programs/wetland.html
US Conference of Mayors. 1999. Recycling America's Land: A National Report on Brownfields Redevelopment, Volume II. Washington (DC): The US Conference of Mayors.
US Environmental Protection Agency. 2000. AirsData Homepage. Office of Air Quality Planning & Standards. http://www.epa.gov/airsdata